CHAPTER 9 HAZARDOUS ELIMINATION SAFETY (HES)

CONTENTS

EXHIBITS

CHAPTER 9 HAZARD ELIMINATION SAFETY (HES)

9.1 INTRODUCTION

Following passage the Highway Safety Act of 1966, the Federal Highway Administration adopted the American Association of State Highway and Transportation Officials (AASHTO) publication "A Policy on Geometric Design of Highways and Streets," (referred to as the AASHTO Green Book), as well as other safety related design and operational procedures. The Surface Transportation Assistance Act of 1982 created the Hazard Elimination Safety (HES) Program by combining several existing safety programs.

The HES Program provides funds for safety improvements on all public roads highways, except the Interstate System. These funds serve to eliminate or reduce the number and severity of traffic accidents at hazardous highway locations, sections, and elements.

Section 152 (a) of Title 23 of the United States Code (U.S.C.) cites the Federal requirements for the HES Program.

> "Each state shall conduct and systematically maintain an engineering survey of all public roads to identify hazardous locations, sections and elements, including roadside obstacles and unmarked or poorly marked roads, which may constitute a danger to motorists and pedestrians, assign priorities for the correction of such locations, section, and elements, and establish and implement a schedule of projects for their improvement."

The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 requires that 10% of the apportioned Surface Transportation Program (STP) funds be made available for safety programs as defined by Sections 130 - Rail-Highway Crossing Program (See Chapter 10, "Rail At-Grade Crossing", in this manual) and 152 (HES) of Title 23 of the United States Code.

Section 2333 of the Streets and Highway Code establishes the Legislature's intent that the total statewide safety funds be split equally between State highway projects and the local transportation projects. Therefore, separate priority lists are established for the State and local HES programs. This chapter describes the local HES program.

9.2 PROJECT ELIGIBILITY

For projects to be eligible for HES funds, a specific safety problem must be identified for correction and the project must correct or substantially improve the condition. In addition, the completed local Federal assistance project must provide for, or consider, the upgrading of related safety features to the appropriate standards.

Local safety projects financed with HES funds may be located on any road functionally classified as "local road or rural minor collector" or higher.

9.3 PRIORITY LISTS

Since the early 1980s two priority lists have been prepared bi-annually; one for those projects qualifying for HES funds based on a calculated Safety Index and another for those projects qualifying based on Work Type priority (defined below). Safety Index projects receive approximately 25 percent of available HES funds, whereas, Work Type priority projects receive approximately 75 percent.

Every two years the Office of Local Programs (OLP) issues instructions for the HES Program and requests that the District Local Assistance Engineer(s) (DLAEs) solicit local entities for candidate HES projects.

9.4 SAFETY INDEX

Projects may qualify for HES funding based on a calculated Safety Index (SI). A Safety Index Calculation Sheet (Exhibit 9-A) must be completed for each project.

Instructions for calculating the project Safety Index are included in Exhibit 9-B. Exhibit 9-C lists the anticipated service life for various improvement types and accident reduction factors for use in calculating the Safety Index.

The "Accident Cost" column includes separate costs for urban and rural areas. Projects within city limits are considered urban; all others are rural. Use the appropriate costs for the combined "Fatal and Injury" accidents as indicated in column "**E**" of the Safety Index Calculation Sheet.

The applicant calculates the Safety Index by using accidents directly related to the correction proposed by the project or using all the accidents at the location and applying a Reduction Factor. Projects are then prioritized statewide by descending safety indexes.

9.5 WORK TYPE IMPROVEMENTS

A Work Type category is used to fund projects with safety needs that cannot be quantified by a Safety Index due to the lack of sufficient accident data. For work type improvements, the Work Type Improvement Sheet (Exhibit 9-D) must be completed. Although the computation of a "Safety Index" may not be practical, those projects with some accident data may be given higher priority within the work type categories.

Work Types are based on a FHWA Annual Safety Report which rates work type categories by a nationwide benefit/cost ratio. The following are the current eligible work type priorities based on an evaluation of highway safety improvements by benefit/cost ratios:

1. Roadway Illumination
2. Relocated or Breakaway Utility Poles
3. Traffic Signs
4. Upgrade Median Barrier
5. Remove Obstacles
6. New Traffic Signals
7. New Median Barrier
8. Upgrade Guardrail *
9. Impact Attenuators
10. Upgrade Traffic Signals

* Includes blunt nose sections.

The priority and work type categories vary by cycle depending on the previous years FHWA Annual Safety Report.

The OLP also administers a Barrier Rail Replacement Program, see Chapter 6 "HBRR" in this manual, utilizing Bridge Replacement and Rehabilitation (HBRR) funds. Therefore, this type of project is not included for HES funding.

A bridge safety project may be financed with both HES funds (approach guard rail) and HBRR funds (barrier rail improvement). To optimize the Federal funding potential, local agencies should include the approach guard rail and/or contiguous guardrail sections in the HES Program and the bridge rail in the HBRR Program.

Many of the work type categories are broad in nature, so some clarification may be needed to determine if a project qualifies under a certain work type. Consult with the DLAE or Office of Local Programs when clarification is necessary.

Since funds are limited, local agencies should consider proposing projects from the higher priority work types and limiting the number of projects for each work type. Work type categories are funded in decreasing percentages, based on priority, with the intent of funding a portion of as many work types as possible.

Only the highest ranked projects on the statewide priority list(s) will be considered for Federal funding. Concerns regarding project funding eligibility may be addressed during the project field review (when requested by the local agency).

9.6 HES FUNDING CONSIDERATIONS

Under ISTEA, the local HES Program receives approximately $9 million per year. The Office of Local Programs (OLP) sets a funding level for the eligible project lists that is approximately 25 percent more than the available funds to allow for selected projects that are later dropped. Safety Index and Work Type projects that are above the cutoff level are Federally funded on a first come/first serve basis. Projects that are not funded may be eligible for the next two year cycle, subject to any pending Federal Highway Act.

Eligible project related costs include preliminary engineering, construction engineering, and construction. Right of way costs are **not** eligible for HES funding.

The maximum level of Federal funds per project, provided that funds are available, is decided administratively each cycle and typically varies from $250,000 to $360,000. Eligible HES project costs are limited to the amount shown on the approved two-year HES Lists. Requests for increases over the amounts on the approved lists are not granted, except in unusual circumstances and subject to availability of funds. Any increase in cost over that used to calculate the "Safety Index" may require recalculation of the "Safety Index". Eligibility is then be based on the revised "Safety Index," and the project could drop below the cutoff level.

The local agency's share of cooperative local agency/State projects (where each agency is responsible for their cost) is based on legs of an intersection, etc. The local agency's share should be identified in the application. Federal funding of the State share is subject to inclusion of the project on the State HES Program list. Conversely,

State programmed cooperative projects cannot use local HES funds unless the local share is identified on the local HES list. Funding levels are established as per agreement with the Caltrans Federal Resources Office of Budgets.

Federal funds are considered "allocated" to each project phase when the OLP Area Engineer authorizes the work through the FHWA delegated authorization process (See Chapter 3 "Authorization" in the *Local Assistance Procedures Manual*). These funds are reserved for the project, but the local agency will not be reimbursed for any phase until **after** the contract award. The OLP Area Engineer, upon receiving the contract award data (bid summary, finance letter) and subject to an executed supplemental agreement, processes the documentation (expenditure authorization and commitment of HES funds) to allow the reimbursement of local agency invoices.

The project reimbursement ratio is determined at the time of the "Authorization to Proceed" regardless of the Federal funds shown on the HES project list. The standard reimbursement ratio for STP Safety funds is 90 percent. However, the 1991 ISTEA does allow certain types of safety improvements to be reimbursed 100 percent. In accordance with 23 U.S.C. Section 120(c) the following types of work are 100 percent Federally funded:

- traffic control signalization
- traffic lights
- impact attenuators
- pavement markings
- commuter carpools and vanpools
- safety rest areas
- traffic signs
- guardrails
- concrete barrier end treatments
- breakaway utility poles
- priority control systems for emergency vehicles at signalized intersections

9.7 SOLICITING PROJECTS

Every two years, the Office of Local Programs requests the District Local Assistance Engineers to solicit local agencies for candidate HES projects. This typically occurs April through June of the odd numbered years. The Districts should take the following actions:

1. Issue instructions to local agencies and solicit candidate "Safety Index" and "Work Type" projects.

   Local agencies should determine the safety problem based on accident data or potential for accidents. The proposed project must solve that safety problem to the greatest extent possible. For example, placing guard rail will not correct an inadequate sight distance problem and a signalization project may not correct a safety problem because it has a high safety index.

   Project estimates should be as complete as possible. The finished project must correct a safety problem with consideration given to meeting Federal guidelines for safety features such as signing and striping or other roadway appurtenances.

   Proposed projects should implement a "quick fix" and not require more than minor right of way or create potential environmental problems. Federal funds are limited and there are time constraints.

2. Review Safety Index calculations to ensure that the data and factors are appropriate. The accidents used to calculate the safety index must be related to

the proposed correction or the reduction factor used.

If all accidents at the location are used to calculate the Safety Index, be sure the reduction factor(s) is used. Make any corrections required and initial the appropriate box in the "Safety Index Calculation Sheet".

3. Review the Work Type information for completeness.

4. Submit two separate lists of projects; one list for projects rated by "safety index" and a second list for projects to be assigned a priority number based on work type.

Each District should prioritize the work type projects within each work type and specify the basis, by project, for determining the project priority. The prioritizing process should emphasize accidents, traffic volume and speeds, especially fatal accidents and speeds in excess of seventy (70) kilometers per hour. This prioritizing assists the OLP in developing a statewide priority for each work type. The District should indicate their recommended highest priority project for each agency.

Submit the lists to the OLP with the following information for each project:

- agency name
- project number
- safety index calculation or work type information, as appropriate
- functional classification of route
- type of work
- Federal funds
- total project cost

Photographs are also required for **all** projects, as well as, collision diagrams for Safety Index projects and Work Type projects when available.

9.8 ESTABLISHING PRIORITY LISTS

The Office of Local Programs develops the Safety Index and Work Type priority lists, determines a cutoff level based on available funding, obtains FHWA concurrence, and notifies the Districts of the list approval. Eligible projects are funded on a first come/first served basis.

9.9 PROJECT PROCESSING

Projects are processed in accordance with project implementation procedures outlined in Chapter 2 "Roles and Responsibilities" in the *Local Assistance Procedures Manual.*

HES projects typically are exempt from FHWA oversight. Most FHWA authorizations and approvals have been delegated to Caltrans. The FHWA may still be involved in process reviews for projects on the National Highway System (NHS).

The OLP Area Engineer typically authorizes the project phases and processes the request for fund obligation to the FHWA. The District Local Assistance Engineers should provide the local agency with the written authorization to proceed with each phase.

9.10 APPROPRIATION CODES

There are four Federal appropriation codes available for HES projects:

· STPLH*	Hazard Elimination	@	90% - 33P
· STPLHG*	Hazard Elimination	@	100% - 33A
· STPLH	Safety (Optional)	@	90% - 33A
· STPLHG	Safety (Optional	@	100% - 33Q

* use these unless otherwise instructed by OLP Area Engineer

9.11 DEADLINES

It is the intent of the HES Program that Federal funds be expended as soon as possible for eligible safety projects that can be designed and constructed in a short time frame. Therefore, a first come/first serve system is used for the list that is usually over-programmed by about 25 percent. Each list has a deadline for obligating project funds (usually by the end of September of the second fiscal year) and awarding the project (by the end of the following December of that year). These deadlines may vary by program cycle.

9.12 EVALUATION

Federal directives require that the results of Safety Improvements be evaluated three years after the project is completed. Each project listed must have a before-and-after evaluation. Safety deficiencies corrected by this program largely justifies the prioritizing methods and future funding. A sample Project Evaluation form is included as Exhibit 9-E.

9.13 REFERENCES

Title 23, USC, Subpart A, Chapter 1, Section 152
Street and Highways Code, Sections 2330-2334
Title 23 USC, Section 120(c)

SAFETY INDEX CALCULATION

CITY/COUNTY OF _____ DATE _____
CALCULATED BY _____
CHECKED BY _____

PROJECT LOCATION _____

PROPOSED IMPROVEMENT _____

PROJECT PURPOSE _____

TOTAL COST (in $1000s) _____ ADT (existing, all directions, in 1000s) _____

NUMBER OF LOCATIONS, OR LENGTH IN MILES _____

SEVERITY OF ACCIDENTS	COLUMN A: TOTAL ACCIDENTS LAST YEAR	B: AVERAGE NO. OF ACCIDENTS PER YEAR	C: REDUCTION FACTOR	D: ACCIDENTS REDUCED	E: ACCIDENT COSTS ($1,000's)		F: LIFE OF IMPROVEMENT	G: SAVINGS IN ACCIDENT COSTS ($1,000's)
		A ÷ 3	**(RF) ****	**B x C**	**urban**	**rural**	******	**D x E x F**
FATAL + INJURY					**24.0**	**61.0**		
PDO					**3.2**			
	TOTALS							

INITIAL ACCIDENT RATE

IAR = $\frac{\text{"B"}}{\text{ADT x 0.365 x N*}}$ =_____

SAFETY INDEX

SI = $\frac{\text{"G"}\ (\text{x } 100)}{\text{Total Improvement Cost}}$ =_____

EXPECTED ACCIDENT RATE

EAR = $\frac{\text{"B" - "D"}}{\text{ADT x 0.365 x N*}}$ =_____

If EAR < ABR**, Calculate Adjusted Safety Index

REDUCED REDUCTION FACTOR

RRF = "C" x $(EAR/ABR)^3$ = _____

ADJUSTED SAFETY INDEX

ASI = $\frac{\text{RRF}}{\text{"C"}}$ x **SI** =_____

* Number of locations, or if other than spot locations, use length in miles w/ minimum length of one mile

** From Exhibit 14-C

District Check by: _____ Date: _____

This page intentionally left blank

INSTRUCTIONS
SAFETY INDEX CALCULATIONS

City/County: Strike out the inappropriate word and add the name of your agency.

Project Location: Show the main roadway and the cross street involved or the distance (to the closest 0.1 mile) to the nearest intersecting roadway.

Proposed Improvements: There may be more than one type of improvement contemplated; such as signals and channelization. All types of improvements for a given project should be listed.

Project Purpose: The purpose of the project is the reason (s) for which it is implemented. It depends on the specific safety deficiencies identified at the project site, as documented in collision diagrams, accident histories, project planning reports, project justification statements, and other sources.

Some possible project purposes are to reduce:

running off the road	head-on collisions
skidding	sideswipes
hitting fixed objects	night accidents
rear-end collisions	hazardous maneuvers

Total Cost: All costs should be added; i.e.: right of way, utility relocations, contributions by others, preliminary engineering, project construction, construction engineering, project administration, etc.

Accidents: Only reported accidents are used since the accident costs have been adjusted to reflect unreported accidents. The total number of all types of accidents is used in calculating the Accident Rate.

Reduction Factor Combinations: The reduction factors show in Exhibit 14-C should be adjusted if either of the following conditions exist:

1. The project is for more than one type of improvement.

   Example: A project consists of constructing left-turn painted channelization at an unsignalized intersection (35% reduction from Exhibit 14-C), and installation of new safety lighting where none now exists (15% reduction of night accidents). If there were an average of 20 accidents/year, with 12 at nigh, then the calculation of the combined reduction factor is:

   Lighting: (12 night acc) x 15% = 1.8 acc. reduced

   Channelization: (20 total acc) - 1.8 acc. = 18.2 x 35% = 6.4 acc. reduced

   Combined: 1.8 = 6.4 = 8.2 total accidents reduced
   8.2 ÷ 20 = 41% combined reduction factor

2. Accident rate check shows it to be too low.

   Calculate your Expected Accident Rate (EAR) and check this against the Accident Base Rate (ABR) show in Exhibit 14-C. If your EAR is lower than the ABR, the reduction factor listed in Exhibit 14-C is not appropriate and must be reduced.

   Example:

   $$EAR = \frac{20 \text{ acc/yr (total)} - 8.2 \text{ acc/yr (reduced)}}{30 \text{ (ADT in thousands)} \times 0.365}$$

   $$= \frac{11.8 \text{ acc/yr (after)}}{10.95} = 1.08 \text{ acc/MV}$$

   Since the Expected Accident Rate after the improvement is greater than the Accident Base Rate (0.80 from Exhibit 14-C) for either type of improvement, it is correct to use the calculated Reduction Factor (RF). But, had the EAR calculated out to be 0.60, then a Reduced Reduction Factor (RRF) would have to be figured as follows:

   $$RRF = 0.41 \text{ (RF*)} \times \left| \frac{0.60 \text{ (EAR)}}{0.80 \text{ (ABR)}} \right|^3 = 0.17$$

   The RRF would then be used to calculate an Adjusted Safety Index.

Life of Improvements, Combined: The life of a standard combined project should be computed by the weighted average (using construction costs) of the different improvements. From the example above:

Cost and expected life of lighting..	$6,000.	15 years
Cost and expected life painted chann...	$2,000	10 years
Total Cost.	$8,000	

$$\frac{\$6,000 \text{ (lighting)}}{\$8,000 \text{ (total)}} = 0.75 \times 15 \text{ yrs} = 11.25 \text{ yrs life}$$

$$\frac{\$2,000 \text{ (channel)}}{\$8,000 \text{ (total)}} = 0.25 \times 10 \text{ yrs} = 2.50 \text{ yrs life}$$

Life of combined projects..... 13.75 yrs

* Reduction factor calculated from the example in 1.

CALCULATION FACTORS FOR HIGHWAY SAFETY PROJECTS

TYPE OF IMPROVEMENT	REDUCTION FACTOR (RF)	ACCIDENT BASE RATE (ABR)
A. New signals (w/ or w/o channelization and/or lighting.	15% of all accidents	1.20
B. Modify signals to reduce accidents (w/ or w/o interconnection)	15% of all accidents	1.20
C. Two-way left-turn lane	25% of all accidents	1.00
D. New lef -turn land		
1. At signalized intersection		
a. With no left-turn phase	15% of all accidents	1.00
b. With left-turn phase	35% of all accidents	1.00
2. At non-signalized intersection	35% of all accidents	0.80
E. New safety lighting (where no lighting exists)	15% of all night accidents	0.80
F. Upgrade traffic signs	5% of all accidents	1.00
G. Upgrade pavement markings	5% of all accidents	1.00
H. Improve pavement texture	10% of all accidents	1.00
I. Signing		
1. Curve warning arrows	20% of all accidents	0.50
2. Advance curve warning with advisory speed	20% of all accidents	0.50
3. 4-way stop	50% of all accidents	0.50
J. Curve correction or superelevation	50% of all accidents	1.00
K. Realignment	50% of all accidents	1.00
L. Reconstruction (combinations & miscellaneous)	20% of all accidents	1.00

LIFE OF IMPROVEMENT (IN YEARS)

INTERSECTION AND TRAFFIC CONTROL

Construct Turning Lanes	10	Install Delineators	2
Provide Traffic Channelization	10	Install Illumination	15
Improve Sight Distance	10	Upgrade Traffic Signals	10
Install Traffic Signs	6	Install New Traffic Signals	10
Install Pavement Marking	2		

ROADWAY AND ROADSIDE

Widen Travel-Way (no new lanes)	20	Relocate Utility Poles	10
Add Lane(s) to Travel-Way	20	Install GR End Treatment	10
Const Median for Traffic Separation	20	Upgrade Guardrail	10
Widen or Improve Shoulder	20	Upgrade Median Border	15
Realign Roadway (except at RRs)	10	Install New Median Barrier	15
Overlay for Skid Treatment	10	Install Impact Attenuators	10
Groove Pav't for Skid Treatment	10	Flatten or Regrade Side Slopes	20
Install Breakaway Sign Supports	10	Remove Obstacles	20
Install Breakaway Utility Poles	10	Install Bridge Approach Guard Rail Transition	10

This page intentionally left blank

HES WORK TYPE IMPROVEMENT

Work Type Category: _____

Applicant: City or County of: _____

Project Location: (attach location map) _____

_____

_____

Describe Safety Problem to be Corrected: _____

_____

_____

_____

Describe Proposed Improvement: _____

_____

_____

Project Cost ($1,000)

Construction	**$**	_____
Preliminary Engineering	**$**	_____
Construction Engineering	**$**	_____
Totals	**$**	_____

Number or Accidents (last 3 years)		**ADT**	**Posted Speed Limit**
Fatal	_____	**Major Direction** _____	_____
Injury	_____	**Minor Direction** _____	_____
PDO	_____		

Was Project Selection Based on a Safety Management System? Yes or No
If not, explain how the project was chosen: _____

_____

_____

Proposed Advertisement Date: _____

Is Right of Way Acquisition Required? Yes or No

Are Any Environmental Problems Anticipated? Yes or No.

Additional Comments to Support the Project: _____

_____

_____

_____

Prepared By: _____
Telephone: _____

This page intentionally left blank

PROJECT EVALUATION

Agency _____ **Project No. HES** _____

Project Location:

Type of Work:

Accident Data	**Fatal Injury**	**Property Damage Only**	**ADT**
Before: Total last 3 yrs.			
After: Total last 2 yrs.			

PHOTOGRAPHS

PHOTOGRAPHS

PHOTOGRAPHS

PHOTOGRAPHS

This page intentionally left blank